Irish Journal of Medical Science (1971 -) (2022) 191:2193–2200
https://doi.org/10.1007/s11845-021-02778-x

ORIGINAL ARTICLE

Does information by pharmacists convince the public to get vaccinated for pneumococcal disease and herpes zoster?

Aygin Bayraktar-Ekincioglu[1] · Emre Kara[1] · Melda Bahap[1] · Mustafa Cankurtaran[2] · Kutay Demirkan[1] · Serhat Unal[3]

Received: 1 August 2021 / Accepted: 8 September 2021 / Published online: 28 October 2021

Abstract

Background Pneumococcal diseases (PN) and herpes zoster (HZ) are preventable infections in the adult population.

Aims This study aimed to identify the vaccination rates at 1 year after pharmacist-led provision of information in the community. The objectives were to reveal the reasons for not being vaccinated and to determine opinions and awareness of PN and HZ vaccination among public.

Methods A prospective study was conducted in five social and solidarity centres in Turkey. Participants were educated by a pharmacist about PN and HZ diseases, vaccinations and reimbursement status, respectively. All participants were followed by telephone 1 year after to determine their vaccination status.

Results A total of 155 participants (72.9% male; mean age was 68.72 ± 9.04 years) were included. With respect to PN and HZ vaccines, it was found that 40% and 12.7% of participants knew about the respective vaccines. Following the pharmacist's educational session, 52.9% and 51.6% were willing to have the respective vaccine, but only 5.7% and 0.8% respectively got vaccinated 1 year after the educational session. Perceived disease severity, provision of information by a pharmacist, and reimbursement status of the vaccines were not associated with the vaccination rates.

Conclusions The public obtain information on vaccines from friends and family members, which may result in misinformation and inappropriate behaviour in vaccination. Although educational sessions provided by pharmacists did not increase the actual vaccination rates for PN and HZ, public willingness to vaccination has increased.

Keywords Herpes zoster · Pharmacist · Pneumococcal diseases · Vaccination · Willingness

Introduction

Preventive health services, particularly vaccinations, become more essential to reduce hospitalisations, avoid unnecessary health expenditures and increase the quality of life in older population [1].

The rate of hospitalisation and mortality due to pneumococcal diseases can be reduced by 60–64% through vaccination [2]. In Germany, pneumococcal vaccination rate was 4.4% in people with underlying high-risk conditions [3]. Rates of vaccinations were 38.7% for the 23-valent pneumococcal polysaccharide vaccine (PPSV-23) and 0.7% for the 13-valent pneumococcal conjugate vaccine (PCV-13) in Spain [4]. In the USA, the rate of vaccinated adults aged 19–64 years at increased risk for the pneumococcal disease was 24.5%, whereas the rate was 69% in adults aged > 65 years [5].

Herpes zoster (HZ) infections account for 20% of the total health care cost for patients 65 years of age and older [6]. Vaccination significantly decreases the risk of development of HZ infection by 51%, postherpetic neuralgia by 67% in people aged over 60 years for 5 years and provides 64% and 18% protection in patients over 65 years and 80 years, respectively [6–8].

According to the recommendations by the US of Advisory Committee on Immunization Practices (ACIP), PCV-13 is no longer routinely recommended for all adults aged ≥ 65 years, and instead, PCV-13 is recommended based

✉ Aygin Bayraktar-Ekincioglu
aygin@hacettepe.edu.tr

[1] Faculty of Pharmacy, Department of Clinical Pharmacy, Hacettepe University, Ankara, Turkey

[2] Faculty of Medicine, Department of Internal Medicine, Division of Geriatrics, Hacettepe University, Ankara, Turkey

[3] Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, Hacettepe University, Ankara, Turkey

on shared clinical decision-making for adults aged ≥ 65 years who do not have an immunocompromising condition, cerebrospinal fluid leak or cochlear implant [9]. The vaccination rate for HZ in adults aged over 60 years was reported as 34.5% [10]. The US government announced a vaccination target whereby for patients over 65 years of age, the target was 90% for influenza, 90% for pneumococcal and 30% for zoster infections [11].

The vaccination rate in adults remains lower than expected due to a variety of reasons [12, 13]. The main barriers for acceptance of vaccines are acknowledged as lack of resources or regular source of care, structure of health organisation or time limitation, patient characteristics, health status, perceived threats/perception of non-efficacy/positive beliefs, previous experiences, inconvenience and intention. Effective promotional strategies such as provision of education and increasing public awareness via social centres could be an appropriate approach to promote vaccination [14, 15]. PN vaccine is reimbursed by the National Health Service; however, HZ vaccine is not reimbursed in Turkey at the time of study.

Studies have shown that knowledge on vaccines about HZ and pneumococcal infections was not adequate [16–19]. Only 2.3% within a low-income status and 16.5% within a high-income status were reported to have had a pneumococcal vaccine in a study from Pakistan [19]. With respect to the HZ vaccine, the main barriers for vaccinations are reported to include uncertainty about effectiveness, lack of awareness, physicians not recommending it and cost [16–19].

This study aimed to identify the vaccination rates at 1 year after pharmacist-led provision of information in the community. The objectives were to reveal the reasons for not being vaccinated and to determine opinions and awareness of PN and HZ vaccination among public.

Methods

This prospective study was conducted in five elderly social and solidarity centres which are coordinated by the municipality and located in the capital city Ankara in Turkey. The study was carried out between September 2017 and March 2018. The study was approved by the Institutional Non-Interventional Clinical Trials Ethics Committee (No: GO-17/728). People who were registered in the solidarity centre, aged over 50 years, not vaccinated previously with available PN (13-valent or 23-valent) or HZ (live attenuated) vaccine in Turkey, not on any immunosuppressive drugs and have no visual or hearing problems and possess a telephone to contact were eligible to participate in the study. Eligible participants were informed about the study by pharmacists, and those participants who agreed to participate and gave written consent were included in the study. People were asked directly to participate while they were spending time in attended solidarity centres. There were no promoting fliers or posters used, and no monetary or other incentives were advertised for participation.

Pharmacists who provided the training in the study were a senior clinical pharmacist and two pharmacists who were Ph.D. candidates in clinical pharmacy. The municipality solidarity centres were considered appropriate for the study since these centres are not hospitals or medical care centres. They are established by the local municipality to provide social activities and informative seminars for persons aged 50 years and over who are registered at the centres. The attendance is voluntary and reflects the demographics of the elderly population in general. Five different centres were contacted to gather a diverse and representative socioeconomic status within the participants of the study. The chosen centres were visited once by pharmacists who led a pharmacist educational session on PN and HZ. During this session which was provided individually for each participant, information on the respective diseases and vaccines was provided by the pharmacists to the participants verbally and by means of a booklet prepared by the researchers for the study purpose. The session between pharmacists and participants consisted of three sections: (1) gathering information on demographics (including self-reported chronic conditions, currently used medications and previous influenza vaccination status) and participant awareness on cold and flu and the influenza vaccine (to provide a general view on awareness and opinions on vaccination); (2) inquiry into the participant's opinion and awareness on PN infection and its vaccines, and the participant's attitudes towards vaccination after provision of general and reimbursement status information, respectively; (3) inquiry into the participant's opinion and awareness on HZ infection and its vaccines, and the participant's attitudes towards vaccination after provision of general and reimbursement status information, respectively. During the session, where applicable, the participants were asked about reasons for choosing not to have the vaccine. Each session per participant took about 20–30 min to complete. Information booklets regarding both PN and HZ infections and vaccines designed for the study were given to the participants at the end of the session. The booklets contained information about risk groups, symptoms, and complications for both diseases as well as general information, side effects and contraindications of the vaccines. The participants' opinions on cold and flu and influenza vaccine were questioned for comparison since the influenza vaccine is more likely to be known by the public in general. Factors affecting vaccination preferences such as demographics, perceived disease severity, the reimbursement status of vaccine, and provision of information by a pharmacist were evaluated. The survey questions were asked separately "after the provision of general information" and "after the information

on reimbursement status." All participants were followed up by means of a telephone call 1 year after the pharmacist-participant session was undertaken at the centres.

For statistical analysis, the IBM Statistical Package for Social Science (SPSS, IBM Corp. Released 2015. Armonk, NY: IBM Corp) version 23 program was used. The data collected during the study was evaluated by using descriptive statistics after normality analysis. Analysis of categorical data of two independent groups was performed by using the chi-square or Fisher exact test. Mann–Whitney *U* test was used for non-parametric variables. Kruskal–Wallis test was used because the assumption could not be obtained for more than 2 groups. The changes that occurred after each stage of the pharmacist-led session were examined with the McNemar test. A *p*-value of <0.05 was considered statistically significant.

Results

The study included 155 participants (72.9% male) with a mean age of 68.72 years ((standard deviation, SD) 9.04), 81.9% were married and 84.5% were non-smoker (Table 1). The median number of chronic diseases and the number of prescribed medications were 2 (range 0–5) and 2 (range 0–11), respectively. The majority of participants ($n=149$, 96.1%) knew about the influenza vaccine; of those, 44 (29.5%) received the vaccine within the previous year and 40 (26.8%) stated that they get vaccinated every year on a regular basis.

Participants who had the flu vaccine in the previous year were older (71.5 vs 66 years, $p=0.001$), had more comorbidities (2 vs 1 disease, $p=0.001$), had at least one comorbidity (100% vs 73.3%, $p<0.001$), used more prescribed medications (3 vs 2 drugs, $p=0.001$), were less likely to experience febrile diseases in the last year (4.5% vs 18.1%, $p=0.038$) and had less allergy history (0% ve 10.5%, $p=0.034$) compared to participants who had not received the flu vaccine in the previous year. Similar findings were observed for participants who take the flu vaccine every year; such as age (67.5 vs 66 years, $p=0.007$), having comorbidities (2 vs 1 disease, $p=0.003$), number of prescribed medications (3 vs 2 medication, $p=0.004$) and having less allergy history (0% vs 10.1%, $p=0.037$).

With respect to PN vaccine, participants having a higher monthly income (> 350 Euro) were more likely to receive the vaccination (62.7% vs 45.5%, $p=0.036$) after general information was provided by a pharmacist. Their preferences to be vaccinated remained the same after the information provided about "reimbursed" status (68.7% vs 50.0%, $p=0.022$). The participants were contacted by telephone 1 year after the pharmacist-led session and only 7 (4.5%) declared to have PN vaccination. There was no significant difference found between vaccinated and non-vaccinated participants in terms of demographics, number of comorbidities, and drug use and perceived health status ($p>0.05$). For HZ vaccine, participants who are older (68.5

Table 1 Demographics of participants ($n=155$)

	n **(%)**
Age (mean ± SD, years)	68.72 ± 9.04
Gender	42 (27.1)
Female	113 (72.9)
Male	
Marital status	28 (18.1)
Single/divorced	127 (81.9)
Married	
Employment status	5 (3.2)
Worker	27 (17.4)
Non-worker	123 (79.4)
Retired	
Education status	4 (2.6)
None	62 (40.0)
Primary school	43 (27.7)
High school	46 (29.6)
University and postgraduate	
Smoking status	24 (15.5)
Smoker	131 (84.5)
None-smoker	
Income/month (Euro)	24 (15.5)
0–170	64 (41.3)
171–350	38 (24.3)
351–500	29 (18.7)
>500	
Social status	15 (9.7)
Living alone	140 (90.3)
Living with someone	
Have comorbidities	30 (19.4)
No	125 (80.6)
Yes	
Comorbidities	74 (47.7)
Hypertension	35 (22.6)
Diabetes mellitus	33 (21.3)
Benign prostate hyperplasia	31 (20.0)
Hyperlipidaemia	21 (13.5)
Coronary artery disease	11 (7.1)
Asthma/Chronic obstructive pulmonary diseases	11 (7.1)
Arrhythmia	9 (5.8)
Hypothyroidism	27 (17.4)
Others*	
Perceived current health status	1 (0.6)
Worst	5 (3.2)
Bad	43 (27.7)
Moderate	83 (53.5)
Good	23 (14.8)
Very good	
Any history of febrile disease in the last year	22 (14.2)
Yes	133 (85.8)
No	

*Gout, rheumatoid arthritis, Sjögren's syndrome, peptic ulcer, malignancies, osteoporosis, Alzheimer's disease dementia, chronic hepatitis b infection, depression

Table 2 Participants' opinions and awareness on HZ and PN vaccines and the vaccination rates at 1-year follow-up

		n (%)	
		HZ	**PN**
Knows about the disease	Yes	102 (65.8)	150 (96.8)
	No	53 (34.2)	5 (3.2)
Perception of the disease severity	Very mild	1 (1.0)	1 (0.7)
	Mild	19 (18.6)	4 (2.7)
	Moderate	2 (2.0)	2 (1.3)
	Severe	61 (39.4)	102 (68.0)
	Very severe	19 (18.6)	41 (27.3)
Already had information on the disease	By physician	8 (7.8)	19 (12.7)
	By pharmacist	3 (2.9)	1 (0.7)
	By family and friends	65 (63.7)	93 (60.0)
	By media	8 (7.8)	11 (7.3)
	By having disease previously	16 (15.7)	20 (13.3)
	By him/herself	2 (2.0)	6 (4.0)
Knows about the vaccine	Yes	13 (12.7)	60 (40.0)
	No	89 (87.3)	90 (60.0)
Had thought about having vaccine before	Yes	1 (7.7)	11 (18.3)
	No	12 (92.3)	49 (81.7)
Preference of having vaccine following pharmacist counselling in general	Yes	80 (51.6)	82 (52.9)
	No	55 (35.5)	52 (33.5)
	Not sure	20 (12.9)	21 (13.5)
Preference of having vaccine following pharmacist counselling about reimbursement status	Yes	41 (26.5)	90 (58.1)
	No	83 (53.5)	43 (27.7)
	Not sure	31 (20.0)	22 (14.2)
Vaccination status 1 year after pharmacist's interview	Yes	1 (0.8)	7 (5.7)
	No	121 (99.2)	115 (94.3)

HZ herpes zoster, *PN* pneumococcal

vs 65 years, $p=0.005$), having lower monthly income (<350 Euro vs > 350 Euro, $p=0.002$), and have more comorbidities (2 vs 1 disease, $p=0.026$) were less likely to prefer having vaccination following the information provided about "non-reimbursed" status. However, no statistical difference was found between the groups that are likely to have or not to have HZ vaccine following provision of general information by a pharmacist. Only one participant (0.8%) declared to have taken the HZ vaccination after 1-year follow-up (Table 2).

Although just over half of the participants indicated their preferences on having vaccine after provision of general information (51.6% for HZ and 52.9% for PN), the proportion was reduced for HZ (non-reimbursed) but increased for PN (reimbursed) vaccines after having information regarding the cost (26.5% for HZ and 58.1% for PN) (Tables 2 and 3). In addition, the comparisons between participants' perception of the disease (categorised as "very mild to moderate" and "severe to worst") versus preference of having HZ or PN vaccine revealed no difference after provision of general information for HZ (47.8% vs 48.1%, $p=1.000$) and PN (42.9% vs 53.1%, $p=0.708$) and provision of information on reimbursement status (30.4% vs 27.8%, $p=0.798$ for HZ; 42.9% vs 58.7%, $p=0.454$ for PN). The level of education on willingness and uptake of the vaccine after provision of information by pharmacists was not significant for PN ($p=0.343$) and HZ ($p=0.983$) vaccines. The reasons for not preferring to get vaccines stated during the interview are summarised in Table 4.

Discussion

This study has investigated public perceptions of PN and HZ vaccines and identified the rates of PN and HZ vaccination after provision of information by pharmacists in community settings in Turkey. It was found that 96.1% of participants knew about the influenza vaccine; 29.5% received the vaccine within the previous year and 26.8% stated that they get vaccinated every year on a regular basis. With respect

Table 3 Attitudes towards vaccination after provision of information on vaccines

		After provision of information on reimbursement status			
		Pneumococcal vaccine, *n* (%)			
		Yes	**No**	**Not sure**	**Total**
After provision of general information	**Yes**	80 (51.6)	1 (0.6)	1 (0.6)	82 (52.9)
	No	6 (3.9)	42 (27.1)	4 (2.6)	52 (33.5)
	Not sure	4 (2.6)	0 (0)	17 (11.0)	21 (13.5)
	Total	90 (58.1)	43 (27.7)	22 (14.2)	155 (100.0)
		Herpes zoster vaccine, *n* (%)			
	Yes	40 (25.8)	23 (14.8)	17 (11.0)	80 (51.6)
	No	0 (0)	55 (35.5)	0 (0)	55 (35.5)
	Not sure	1 (0.6)	5 (3.2)	14 (9.0)	20 (12.9)
	Total	41 (26.5)	83 (53.5)	31 (20.0)	155 (100.0)

to PN and HZ vaccines, it was found that 40% and 12.7% of participants know about the vaccines, 52.9% and 51.6% were willing to have the vaccine following a pharmacist-led educational session, but only 5.7% and 0.8% respectively got vaccinated 1 year after the pharmacist-led educational session. Perceived disease severity, provision of information by a pharmacist and reimbursement status of the vaccines seem not to be the determinant for vaccination rate. Furthermore, most participants knew about these vaccines from the friends and family members but not from the health care providers, which may result in misinformation. Besides, cultural differences may have a role in public perception and actual vaccination behaviour. These findings have shown the distinct gap between knowledge, willingness and existent vaccination status among the public. Therefore, pharmacist-led patient education activities could be more effective, if counselling is undertaken in community pharmacies on regular basis.

A study conducted in Turkey found that 33.4% and 9.9% of patients having indications for vaccination are vaccinated for influenza and PN vaccine, respectively [20]. Although PN vaccine has been available in Turkey since 1994 and reimbursed by the government for high-risk group since 2007, the vaccination rate was found to be low at only 2% in elderly and adults at high-risk group. Reasons attributed for the low vaccination rate included lack of effective vaccine delivery program and/or offering vaccination in different care settings in the country [21].

Another study conducted in Turkey by Ahmad Hamidi et al. identified that 46.4% and 53.6% of patients had an indication for PN and influenza vaccination, but only 3.6% and 8.6% respectively were vaccinated [22].

Korkmaz et al. indicated that physician recommendation is one of the main triggers for patients to get vaccinated. However, enhanced knowledge and awareness on potential risk groups as well as vaccine efficiency and adverse effects will increase the vaccination rates in adult population [23]. MacDougall et al. have also demonstrated that confidence in effectiveness of vaccines was higher among health care professionals (HCPs) than the public, whereas the public was more likely to accept vaccine in the case of recommendations by HCPs, adequacy of reimbursement was an issue for

Table 4 Reasons for not preferring to have PN and HZ vaccines

Reasons	After provision of general information		After reimbursement status information	
	HZ, *n* (%)	**PN, *n* (%)**	**HZ, *n* (%)**	**PN, *n* (%)**
Feeling healthy/prior exposure to infection	25 (47.1)	25 (49.0)	22 (26.5)	20 (46.5)
Side effects	2 (3.8)	–	1 (1.2)	–
Lack of information (perceived)	3 (5.7)	–	3 (3.6)	–
Polypharmacy	3 (5.7)	1 (2.0)	2 (2.4)	1 (2.3)
Anti-vaccination attitude	11 (20.7)	8 (15.7)	11 (13.3)	7 (16.3)
Allergy (self-indicated)	2 (3.8)	2 (3.9)	2 (2.4)	2 (4.7)
Cost	–	1 (2.0)	30 (36.1)	–
Reason not specified	7 (13.2)	14 (27.4)	12 (14.5)	13 (30.2)
Total	53	51	83	42

HZ herpes zoster, *PN* pneumococcal

physicians and pharmacists (but not nurses). They concluded that barriers and facilitators to adult immunization are interrelated; acceptance of vaccination was dependent on vaccine type, disease risk and current health status, and lack of trust or knowledge of vaccine may be the result of physicians lacking time for education of the public [24]. The main challenging issues for adult vaccination were previously reported as reimbursement and insurance coverage, administrative cost (pharmacists' time and vaccine stocking cost) and education of patient/public. The patients' concerns about adverse drug reactions (20%) and cost (25%) of the vaccine, pharmacists' concerns on education/promotion (within or outside pharmacy) to the public and patients' willingness to participation were identified as the most important factors for a successful vaccination program to be established in pharmacies [25].

The American Health-System Pharmacists (ASHP) recommends 6 activities for pharmacy-based immunization program to be effective. These include history and screening, patient counselling, documentation, formulary management, administrative measures and public education [26]. A pharmacist-based compliance program for PN vaccination was introduced after the ACIP recommendations showed that the percentage of patients who received the correct vaccination formulation is increased from 40 to 95.6%; in addition, the rate increased from 2 to 100% in vaccine naïve-people aged over 65 years of age [27].

A meta-analysis evaluated the pharmacist's impact on immunization rate has shown that vaccination rate is increased when pharmacists are involved as educator, facilitator or administrator (RR: 2.74) in immunization activities in primary care settings. The convenient location, easy accessibility and extended hours of facilities in pharmacies increase the rate of acceptance by patients in immunization practice [28]. Furthermore, the study indicated that face to face communication, education and promotional materials provided by pharmacists in community settings can help to improve the rates of vaccination including HZ vaccine [29].

Unlike previous studies, this study has focused on the public opinions and awareness on vaccines, not on the specific group of patients. Therefore, any activities to reinforce public willingness to have vaccine would be valuable. Since reimbursement issues, patients' negative beliefs and HCPs' attitudes towards vaccines are known to be one of the main barriers for not being vaccinated, these barriers can be overcome through the involvement of pharmacists who practise in the community. The active involvement of pharmacists should be considered in adult immunization and public education programs in countries such as Turkey where over 25,000 community pharmacies operating 24/7 sustain the primary care settings.

Although the rate of vaccinations was found low in this study, it was promising to note that attitudes of participants on having vaccines have changed where the percentage of participants not thinking about having vaccines before is increased for HZ and PN vaccines after interview with pharmacists.

The COVID-19 pandemic which started in March 2020 in Turkey created fear for infectious diseases and increase the awareness of vaccination in the community. Given the fact that this study was conducted before the COVID-19 pandemic, having decreased public awareness and perceptions on vaccines may have resulted in a low ratio of vaccination.

This study also had certain inevitable limitations. Data on vaccination history, comorbidities and current medications as well as other demographics were self-reported, which may underestimate the actual clinical and social status of participants. The participation was voluntary, and therefore may not reflect the overall population attitudes and characteristics. The inclusion of limited number of participants can be considered as the main problem. This occurred due to participants having concerns about talking about vaccination and giving written consent to participate, and also having a wide range of drug information expectations from pharmacists. These issues have created circumstances where the participants got distracted during the interview. In addition, having contact with the participants once was not enough to reinforce the importance of vaccination; therefore, pharmacists' counselling should have been performed on regular basis to increase the rate of vaccination. It was interesting to note that nearly half of the participants indicated the reason for not having vaccination as 'not specified reason' and 'anti-vaccination attitudes'. Moreover, a potential collaboration for vaccination between family physicians of the participants and pharmacists was not established, and communication was performed through the participants, which may have caused missed opportunities in vaccination. Having no control group in the study did not allow to make any robust comparison to show the impact of pharmacists on vaccination rates.

Conclusions

Although an education by pharmacists did not increase the actual vaccination rates for PN and HZ among the public, the willingness of vaccination was increased.

Undoubtedly, the COVID-19 pandemic has shown the importance of primary healthcare services (particularly community pharmacy services) in the management of infections to prevent the spread of disease, reduce overall morbidity and mortality and protect society and individuals at risk. Therefore, identifying susceptible and eligible patients who would benefit from vaccination and potential reasons for not being vaccinated are critical issues for reducing the disease

burden, such as elderly and people with comorbid diseases. In conclusion, firm leadership and successful coordination between healthcare facilities will be able to track adults for immunization and increase the vaccination rates.

Availability of data and material The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Competing interests The authors declare no competing interests.

References

1. Tazkarji B, Lam R, Lee S, Meiyappan S (2016) Approach to preventive care in the elderly. Can Fam Physician 62(9):717–721
2. Blasi F, Mantero M, Santus P, Tarsia P (2012) Understanding the burden of pneumococcal disease in adults. Clin Microbiol Infect 18(Suppl 5):7–14. https://doi.org/10.1111/j.1469-0691.2012.03937.x
3. Schmedt N, Schiffner-Rohe J, Sprenger R et al (2019) Pneumococcal vaccination rates in immunocompromised patients-a cohort study based on claims data from more than 200,000 patients in Germany. PLoS ONE 14(8):e0220848. https://doi.org/10.1371/journal.pone.0220848
4. Vila-Córcoles A, Ochoa-Gondar O, de Diego C et al (2019) Pneumococcal vaccination coverages by age, sex and specific underlying risk conditions among middle-aged and older adults in Catalonia, Spain, 2017. Euro Surveill 24 (29). https://doi.org/10.2807/1560-7917.Es.2019.24.29.1800446
5. The Centers for Disease Control and Prevention (CDC) (2017) Vaccination coverage among adults in the United States, National Health Interview Survey, 2017. Available at: www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/NHIS-2017.html. Access date: April 15, 2021.
6. Worz C, Martin CM, Travis C et al (2017) Vaccines for Older Adults. Consult Pharm 32(Suppl C):6–13. https://doi.org/10.4140/TCP.s.2017.006
7. Oxman MN, Levin MJ, Johnson GR, et al (2005) A vaccine to prevent herpes zoster and postherpetic neuralgia in older adults. New Engl J Med 352(22):2271–2284. https://doi.org/10.1056/NEJMoa051016
8. Lydick E, Epstein RS, Himmelberger D, White CJ (1995) Herpes zoster and quality of life: a self-limited disease with severe impact. Neurology 45(12):S52–S53. https://doi.org/10.1212/WNL.45.12_Suppl_8.S52
9. Matanock A, Lee G, Gierke R et al (2019) Use of 13-valent pneumococcal conjugate vaccine and 23-valent pneumococcal polysaccharide vaccine among adults aged >/=65 years: updated recommendations of the advisory committee on immunization practices. MMWR Morb Mortal Wkly Rep 68(46):1069–1075. https://doi.org/10.15585/mmwr.mm6846a5
10. Terlizzi EP, Black LI (2018) Shingles vaccination among adults aged 60 and over: United States, 2018. NCHS Data Brief, no 370. Hyattsville, MD: National Center for Health Statistics. 2020.
11. Healthy People (2020) immunization and infectious diseases objectives. Office of Disease Prevention and Health Promotion. Available at https://www.healthypeople/gov/2020/topics-objectives/topic/immunization-and-infectiousdiseases/objectives. Accessed date: April 15, 2021.
12. The World Health Organisation Immunization coverage. https://www.who.int/news-room/fact-sheets/detail/immunization-coverage. Accessed 30.09.2019
13. Centers for Disease Control and Prevention (2016) Vaccination coverage among adults in the United States, National Health Interview Survey 2016. https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/NHIS-2016.html. Accessed 30.09.2019
14. Kan T, Zhang J (2018) Factors influencing seasonal influenza vaccination behaviour among elderly people: a systematic review. Public Health 156:67–78. https://doi.org/10.1016/j.puhe.2017.12.007
15. Blasi F, Akova M, Bonanni P et al (2017) Community-acquired pneumonia in adults: Highlighting missed opportunities for vaccination. Eur J Intern Med 37:13–18. https://doi.org/10.1016/j.ejim.2016.09.024
16. Satman I, Akalin S, Cakir B et al (2013) The effect of physicians' awareness on influenza and pneumococcal vaccination rates and correlates of vaccination in patients with diabetes in Turkey an epidemiological study "diaVAX." Hum Vacc Immunother 9(12):2618–2626. https://doi.org/10.4161/hv.25826
17. Lam ACY, Chan MY, Chou HY et al (2017) A cross-sectional study of the knowledge, attitude, and practice of patients aged 50 years or above towards herpes zoster in an out-patient setting. Hong Kong Med J 23(4):365–373. https://doi.org/10.12809/hkmj165043
18. Paek E, Johnson R (2010) Public Awareness and knowledge of herpes zoster: results of a global survey. Gerontology 56(1):20–31. https://doi.org/10.1159/000240046
19. Baig SA, Hassan M, Ahmed SM et al (2014) A cross-sectional study to investigate pneumococcal vaccination in the elderly in a low income county Patient knowledge, awareness, and attitudes of vaccination and prevalence rates by socioeconomic status. Hum Vacc Immunother 10(4):1024–1027. https://doi.org/10.4161/hv.27697
20. Ciftci F, Sen E, Demir N, Kayacan O (2017) Which factors effects patients belief and attitudes about influenza vaccination? Tuberk Toraks 65(4):308–316. https://doi.org/10.5578/tt.66324
21. Akin L, Kaya M, Altinel S, Durand L (2011) Cost of pneumococcal infections and cost-effectiveness analysis of pneumococcal vaccination at risk adults and elderly in Turkey. Hum Vaccin 7(4):441–450. https://doi.org/10.4161/hv.7.4.14188
22. Ahmad Hamidi A, Gelmez Tas B, Gunduz A et al (2018) Immunization rates of pneumococcal, influenza and tetanus vaccines and knowledge and attitudes of adult patients who receive inpatient treatment at hospital: point prevalence study. Hum Vaccin Immunother 14(11):2649–2653. https://doi.org/10.1080/21645515.2018.1489187
23. Korkmaz P, Pasali Kilit T, Onbasi K et al (2019) Influenza vaccination prevalence among the elderly and individuals with chronic disease, and factors affecting vaccination uptake. Cent Eur J Public Health 27(1):44–49. https://doi.org/10.21101/cejph.a5231
24. MacDougall DM, Halperin BA, MacKinnon-Cameron D et al (2015) The challenge of vaccinating adults: attitudes and beliefs of the Canadian public and healthcare providers. BMJ Open 5(9):e009062. https://doi.org/10.1136/bmjopen-2015-009062
25. Islam JY, Gruber JF, Lockhart A et al (2017) Opportunities and challenges of adolescent and adult vaccination administration within pharmacies in the United States. Biomed Inform Insights 9:1178222617692538. https://doi.org/10.1177/1178222617692538
26. Couch KA, Geide T (2014) ASHP therapeutic position statement on strategies for identifying and preventing pneumococcal

resistance. Am J Health Syst Pharm 71(5):417–424. https://doi.org/10.2146/ajhp130514
27. King GS, Judd WR (2017) Impact of a pharmacist-led pneumococcal vaccine compliance program. Am J Health Syst Pharm 74(23):1948–1952. https://doi.org/10.2146/ajhp160916
28. Isenor JE, Edwards NT, Alia TA et al (2016) Impact of pharmacists as immunizers on vaccination rates: a systematic review and meta-analysis. Vaccine 34(47):5708–5723. https://doi.org/10.1016/j.vaccine.2016.08.085
29. Eid DD, Meagher RC, Lengel AJ et al (2015) The impact of pharmacist interventions on herpes zoster vaccination rates. Consult Pharm 30(8):459–462. https://doi.org/10.4140/TCP.n.2015.459